

Treatment of Hazardous Wastes, Surrogate Mixed Wastes and Energetics Using the ECO LOGIC Process

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Abstract

Science Applications International Corporation (SAIC), in partnership with ELI Eco Logic International Corporation (ECO LOGIC), has just completed the first year of a two year contract with the Federal Energy Technology Center in Morgantown, WV (**Maria Vargas, Contracting Officer's Representative**), to provide the basic and applied research necessary to support demonstration of the economical and environmental feasibility of the ECO LOGIC Process for the cleanup of complex hazardous wastes and low level mixed wastes. Pilot-scale testing activities were planned so that performance of the ECO LOGIC Process in treating hazardous wastes and energetics in the first year of the contract could then be used to identify low level mixed wastes suitable for testing in the second year of the contract.

The ECO LOGIC Process involves the gas-phase reduction of organic compounds by hydrogen at temperatures of approximately 850°C. Chlorinated hydrocarbons, such as PCBs, dioxins and furans are chemically reduced to methane and hydrogen chloride (HCl), while nonchlorinated organic contaminants such as PAHs, are reduced methane and simple light hydrocarbons. The HCl can be recovered as acid or neutralized and the methane is reused as fuel in the Process after analytical testing.

Complex hazardous wastes identified for testing in the first year of the contract included: PCB- and metals-contaminated soils from the Burn Pit Area at the Naval Inventory Control Point (NAVICP) site in Mechanicsburg, PA; artillery shell casings contaminated with TNT, Composition B and Yellow D, which were provided by the U.S. Army's Armament, Research, Development and Engineering Center (ARDEC) at Picatinny Arsenal, NJ; and napalm, which was provided by the Naval Sea Systems Command (NAVSEA).

Testing on each of these wastes was performed at the U.S. Army's Edgewood Research and Development Engineering Center (ERDEC) Toxic Test Chamber at Aberdeen Proving Grounds, MD.

Complete NEPA documentation was provided and a TSCA R&D permit application was submitted to and approved by EPA Headquarters for the testing on the PCB-contaminated soils.

The first series of tests were performed on PCB- and metals-contaminated soils. Two 4 hour test runs were performed on approximately 20 kg soil samples. The first test run was performed on a soil sample containing approximately 100 mg/kg of PCBs with moderate metals contamination (total metals levels of approximately 2 mg/kg); the second test run was performed on a soil sample containing over 6,000 mg/kg of PCBs with minimal metals contamination. Samples were processed through the pilot-scale system equipped with a thermal reduction mill to desorb organic contaminants from the soil. While all analytical test data have yet to be completely validated, treated soil samples from these two tests showed PCB levels of not detected (DL= 33 ug/kg) and 75 ug/kg, respectively, while each treated soil sample passed TCLP testing. Results from these tests verify the ECO LOGIC Process' ability to destroy organic contaminants in a solid matrix, leaving metal contaminants intact without increasing their mobility.

The second set of tests were performed on three different types of energetics - TNT, Composition B (TNT and RDX) and Yellow D (ammonium picrate). These energetics are used primarily as propellants in different types of artillery shells. Testing was first performed on neat samples of each energetic, progressing to a series of two test runs on 105 mm shell casings lined with 10 grams of each energetic. Both neat energetic samples and shell casings were processed through the pilot-scale system equipped with a sequencing batch vaporizer (SBV) unit to desorb the energetics from the shell casings. While all analytical test data have yet to be completely validated, neat energetic samples were completely destroyed, while shell casings lined with energetic were decontaminated with a minimal amount of nonenergetic residue remaining. Results from these tests verify the ECO LOGIC Process' ability to destroy complex nitrogen-based materials such as energetics and further supports commercial-scale metal parts decontamination results obtained on PCB-contaminated transformers and capacitors in Canada and Australia.

The final series of tests were performed on samples of napalm obtained from the Fallbrook Naval Air Station in California. Napalm is currently stored in aluminum canisters at Fallbrook. Three test runs were performed on an aluminum container with approximately 12 ounces of napalm using the pilot-scale system equipped with an SBV unit. While all analytical test data have yet to be completely validated, napalm was destroyed in all three test runs. In the first two test runs, the aluminum container was melted down into an ingot, while the third test left the container intact. Results from these tests verify the ability of the ECO LOGIC Process to destroy organic contaminants in a semi-solid, jellied matrix in-situ in aluminum containers.

Results from all testing will be used to select candidate low level mixed wastestreams for surrogate testing at pilot-scale over the next year. DOE operating sites will be contacted in an effort to identify wastestreams that are high priority within the DOE complex and, based on the results of surrogate testing, funding for pilot-scale testing on actual low level mixed waste at a DOE operating site will be investigated.